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Understanding Continued IT Usage: An Extension to the Expectation-Confirmation Model in IT Domain

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Abstract

A model that has been proposed to investigate the continued IT usage behavior is the Expectation-Confirmation Model in IT Domain (ECM-IT). This paper proposes an extension to the ECM-IT that incorporates perceived ease of use; provide empirical evidence for the utility of the extended ECM-IT; and deepen our knowledge about the factors affecting the continued IT usage behavior. The extended ECM-IT was tested with data collected from 1,826 Mobile Data Services (MDS) users. The LISREL analysis showed that the extended ECM-IT has good explanatory power ($R^2=67\%$), with perceived ease of use having a stronger impact on user satisfaction and continued usage intention than perceived usefulness. Hence, the extended ECM-IT can provide valuable additional information that is relevant for understanding continued IT usage. The strong impact of perceived ease of use on user satisfaction and intention implies that the nature of the target technology can be an important boundary condition in understanding the continued IT usage behavior. At a more specific level, the extended ECM-IT provides practitioners with deeper insights into how to address customer satisfaction and retention.

Keywords: Continued IT usage, Expectation-confirmation model, Technology acceptance, Survey research

1. Introduction

A major stream of IS research is identifying the antecedents of individual users' adoption and usage of information technology (IT) (Taylor and Todd, 1995), with a variety of theoretical perspectives (e.g., Technology Acceptance Model, Innovation Diffusion Theory) advanced to address this issue. However, prior studies based on these perspectives have examined factors that cause users to "initially adopt a new IT" (i.e., use an IT for the first time), rather than the factors that influence users to "continue to use an IT" after they had adopted the technology (Bhattacharjee, 2001b; Karahanna et al., 1999).

According to Bhattacharjee (2001b), the eventual success of a new technology is more dependent on users' continued usage of the IT rather than their initial adoption. This is because infrequent and ineffective usage of the IT after the initial adoption may incur undesirable costs or result in a waste of effort to develop the IT. Furthermore, in subscription-based IT services such as online travel agencies, online banks, and online newspapers, the continued usage (i.e., user retention) is critical to their survival in the marketplace (Bhattacharjee, 2001a; 2001b; Parthasarathy and Bhattacharjee, 1998; Reichheld and Schefter, 2000). The retainment of existing subscribers can greatly affect the profitability of such service firms. Previous studies showed that increasing customer retention rate by 5% could result in a decrease of operating costs by 18% (Crego and Schiffrin, 1995), and

contribute to an increase in profits by 25% to 95% (Reichheld and Sasser, 1990). Given the empirical support for the impact of continued usage on the success of an IT, finding the salient factors that affect users' post-adoption behavior, which is either to continue or to discontinue usage of an IT, becomes critical.

More recently, researchers have attempted to empirically test the determinant structure of continued IT usage behavior (e.g., Bhattacharjee, 2001b; Bhattacharjee and Premkumar, 2004; Karahanna et al., 1999). Our study builds on these efforts by extending the "Expectation-Confirmation Model" in IT domain (ECM-IT)¹—a theoretical model by Bhattacharjee (2001b) that was developed specifically to understand users' continued IT usage behavior. In order to enhance our understanding of continued IT usage behavior, our study incorporates an additional user perception—perceived ease of use—into the original ECM-IT. As suggested by Taylor and Todd (1995), factors believed to be relevant to the technology usage can be derived from different streams of literature, such as diffusion of innovation and consumer behavior.

Another research focus of our study is on the impact of the technological nature of a specific target IT on continued usage behavior. According to Orlikowski and Iacono (2001), there is no single conceptual snapshot of IT that will capture all usage contexts. Thus, the nature of a target IT being studied—characteristics and usage contexts of the IT artifact—should play an important role in explaining user behavior (Benbasat and Zmud, 2003). Mobile Data Services (MDS) is a new breed of IT innovation which is gradually becoming omnipresent in our daily life. Its usage encompasses a broad range of activities—both work-related activities and fun activities. While the usage of typical IT innovations in prior IS research are well defined, simple, and of limited function (e.g., word processor (Davis et al., 1989) and e-mail (Gefen and Straub, 1997)), the interaction of MDS with its users is far more complex and comprehensive to support diversified needs and expectations. Nicholas Negroponte, an IT innovation guru, in his recent keynote speech at a mobile technology forum (Chosun Daily, 2005) states that the use of mobile services through mobile devices is very complex and inconvenient. By studying a technology with a complex nature—MDS, we attempt to increase our knowledge about the role of technological nature as a boundary condition in explaining users' continued IT usage decision processes.

In summary, the objectives of this study are twofold. First, the findings of this study are expected to provide empirical validation for the utility of the extended ECM-IT and the factors affecting continued IT usage. Second, this study is expected to help us better understand the role of the nature of an IT being investigated in the continued IT usage context. At a more practical level, this study can provide practitioners with deeper insights into how to address customer satisfaction and continued usage behavior with the IT of interest in this study—MDS.

2. Theoretical Background

Since the early 1970s, much effort has been made in consumer behavior research to investigate consumers' post-purchase behavioral processes (Churchill and Surprenant, 1982). Among the research frameworks used in this effort, the "expectancy-confirmation² paradigm" is popularly used to explain consumers' satisfaction and re-purchase decisions in a wide array

¹ For the sake of convenience, the model will be called "ECM-IT" throughout the paper hereafter.

² In consumer behavior literature, "disconfirmation" is used interchangeably with "confirmation". For the sake of consistency with Bhattacharjee's model, "confirmation" is used in this paper.

of post-purchase contexts (e.g., Anderson and Sullivan, 1993; Churchill and Surprenant, 1982; Oliver, 1993; Oliver and DeSarbo, 1988; Yi, 1991).

The vast majority of prior studies using this paradigm posit that consumer satisfaction decisions are determined by two major constructs: initial expectations (pre-purchase expectations) on a product/service, and discrepancies between expectations and product/service performance (disconfirmation). According to this framework, buyers first develop expectations about a product/service before purchase. Second, their consumption experiences with it build perceptions about its performance. Third, by assessing perceived performance against their frame of reference (i.e., expectations), they either confirm or disconfirm pre-purchase expectations. That is, a buyer's expectations are confirmed when a product/service performs as much as expected; negatively disconfirmed when it performs worse than expected; and positively disconfirmed when it performs better than expected (Churchill and Surprenant, 1982). In turn, disconfirmation and expectations additively affect the buyer's level of satisfaction with the product/service. Finally, the buyer's level of satisfaction determines re-purchase intentions.

Drawing attention to the substantial differences between initial adoption and continued usage behavior in the IT context, Bhattacharjee (2001b) developed and empirically tested an Expectation-Confirmation Model of continued IT usage (ECM-IT). ECM-IT is rooted in the expectancy-confirmation paradigm (see Figure 1). Viewing IT users' continued usage decisions as similar to consumers' repeat purchase decisions, the model predicts users' intentions to continue usage of an IT with three antecedent constructs: (1) user satisfaction with the IT; (2) extent of user confirmation; and (3) post-adoption expectations, represented by perceived usefulness.

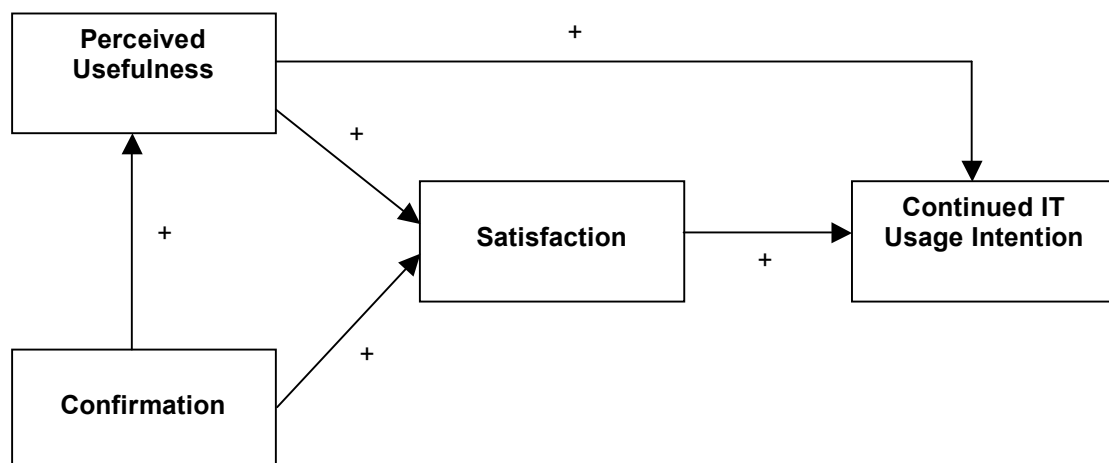


Figure 1. Expectation-Confirmation Model of Continued IT Usage (ECM-IT)

Despite its structural adaptation from the expectancy-confirmation paradigm, Bhattacharjee's (2001b) model possesses some differences. First of all, ECM-IT focuses on post-adoption expectations. It posits that a user's expectation towards using an IT after gaining experiences from using it should be different from those expectations before using it (Bhattacharjee, 2001b; Fazio and Zanna, 1981; Karahanna et al., 1999). An individual keeps updating expectation towards using an IT as he/she gains experiences from using it. LaTour and Peat (1980) found that expectations based on consumers' direct experiences were the major determinant of consumer satisfaction. From this perspective, ECM-IT theorizes that the post-

adoption expectation (rather than pre-adoption expectation) plays an important role in determining IT users' satisfaction decisions. Second, post-adoption expectation is represented by perceived usefulness in ECM-IT. The rationale behind this can be found in the definition of expectation. Proponents of the expectancy-confirmation paradigm have defined expectation as individual beliefs or sum of beliefs about the levels of attributes possessed by a product (see Bearden and Teel, 1983; Churchill and Surprenant, 1982; Oliver and Linda, 1981). Following this definition, ECM-IT uses perceived usefulness as the measure of expectation, since among the cognitive beliefs in IS adoption and usage, perceived usefulness has demonstrated itself to be the most consistent and salient one in determining the user intention over time (e.g., Davis et al., 1989; Karahanna et al., 1999; Venkatesh, 2000). Third, perceived performance is not included in ECM-IT. ECM-IT assumes that the effect of perceived performance is already captured by the confirmation construct (Bhattacharjee, 2001b). The exclusion of perceived performance from the model further implies that the effect of perceived performance is totally mediated by confirmation (Yi, 1991).

There are five hypothesized links in ECM-IT. First, a user's satisfaction has positive influence on his/her intention to continue usage of an IT. In the satisfaction literature, a consumer's level of satisfaction is the main factor for the consumer's decision to re-purchase products or patronize services (e.g., Bearden and Teel, 1983; Cronin et al., 2000; Oliver, 1993; Szymanski and Henard, 2001), which is similar to the continued usage of IT products or services. Next, a user's levels of confirmation and perceived usefulness (i.e., post-adoption expectation) are two key determinants of satisfaction. Since a user's confirmation implies that he or she achieves expected benefits through the usage experiences with the target IT (vice versa for disconfirmation), it affects the user's satisfaction level positively. As in the expectancy-confirmation paradigm, perceived usefulness has a positive impact on satisfaction by working as a baseline for reference against confirmation judgments. The theoretical support for this relationship can be found in Helson (1964)'s adaptation level theory. It posits that one perceives stimuli only in relation to an adapted level (Yi, 1991). Prior consumer behavior research found that the higher (lower) a user's expectation is, the higher (lower) is the subsequent satisfaction level (Oliver and DeSarbo, 1988). Moreover, IT adoption studies have consistently found that perceived usefulness is the most important factor in determining users' adoption intentions (e.g., Davis et al., 1989; Taylor and Todd, 1995; Venkatesh and Davis, 2000). In this light, ECM-IT hypothesizes a direct positive link from perceived usefulness to a user's intention to continue IT usage. Finally, the level of confirmation resulting from the usage experiences is hypothesized to positively affect perceived usefulness. Bhattacharjee (2001b) suggests that perceived usefulness could be adjusted by confirmation experience, especially when a user's initial perceived usefulness is not concrete because he/she is not sure what to expect from the usage of an IT.

3. Research Model

An extension of ECM-IT was developed by incorporating perceived ease of use into the original ECM-IT framework. Perceived ease of use has been widely used to explain IT adoption and usage behavior in previous literature, especially in many studies based on the Technology Acceptance Model (TAM). In fact, the ECM-IT developed by Bhattacharjee (2001b) has two origins. Although the main framework came from the Expectation-Confirmation paradigm in the marketing, one of the main constructs of the ECM-IT was adapted from TAM (i.e., perceived usefulness). The inclusion of perceived usefulness in the ECM-IT was justified by its consistent predictive power of the usage behavior before and after IT adoption in many TAM-based studies (Bhattacharjee, 2001b). From this perspective, we further attempted to test the possibility of developing a more complete model of continued

IT usage by taking into account another important user perception (i.e., perceived ease of use), which has been widely used to explain IT adoption and usage behavior in previous literature. The inclusion of perceived ease of use in the ECM-IT also enables us to better understand the role of the complex nature of an IT as a boundary condition in explaining user behavior in the continued IT usage context. In prior adoption studies (e.g., Moore and Benbasat), the complexity of IT usage is closely associated with perceived ease of use. Also, some researchers attributed the effect of perceived ease of use on behavioral intention to the nature of the IT being studied (Subramanian, 1994; Teo et al., 1999).

Indeed, the further extension of ECM-IT that incorporates existing important user perceptions can help to better understand the continued usage behavior (Bhattacharjee, 2001b). Such integration of different perspectives to better understand a certain phenomenon can be found in previous literature. For example, Moore and Benbasat (1991), Taylor and Todd (1995), and Venkatesh and Morris (2000) attempted to integrate constructs from different adoption perspectives (e.g., TAM, TPB, Innovation Diffusion) into a single framework to better explain the initial adoption behavior.

Given the accumulated evidence of the significant impact of perceived ease of use on both perceived usefulness and IT usage intention from prior TAM-based studies, perceived ease of use is added to the ECM-IT. Following the perspective that post-adoption expectation in the ECM-IT consists of users' beliefs about the attributes possessed by an IT (Bhattacharjee, 2001b), the post-adoption expectation in the proposed model is represented by both perceived usefulness and perceived ease of use. As another component of post-adoption expectation, perceived ease of use is expected to have a positive influence on satisfaction. Further, as theorized in TAM, perceived ease of use is expected to have both a direct influence and an indirect impact via perceived usefulness on continued IT usage intention. With the same line of reasoning applied to the relationship between confirmation and perceived usefulness in the ECM-IT, the level of confirmation is also hypothesized to positively affect perceived ease of use. As a user gains confirmation experience, the user's perceived ease of use will become more concrete and updated. Figure 2 presents the EECM-IT.

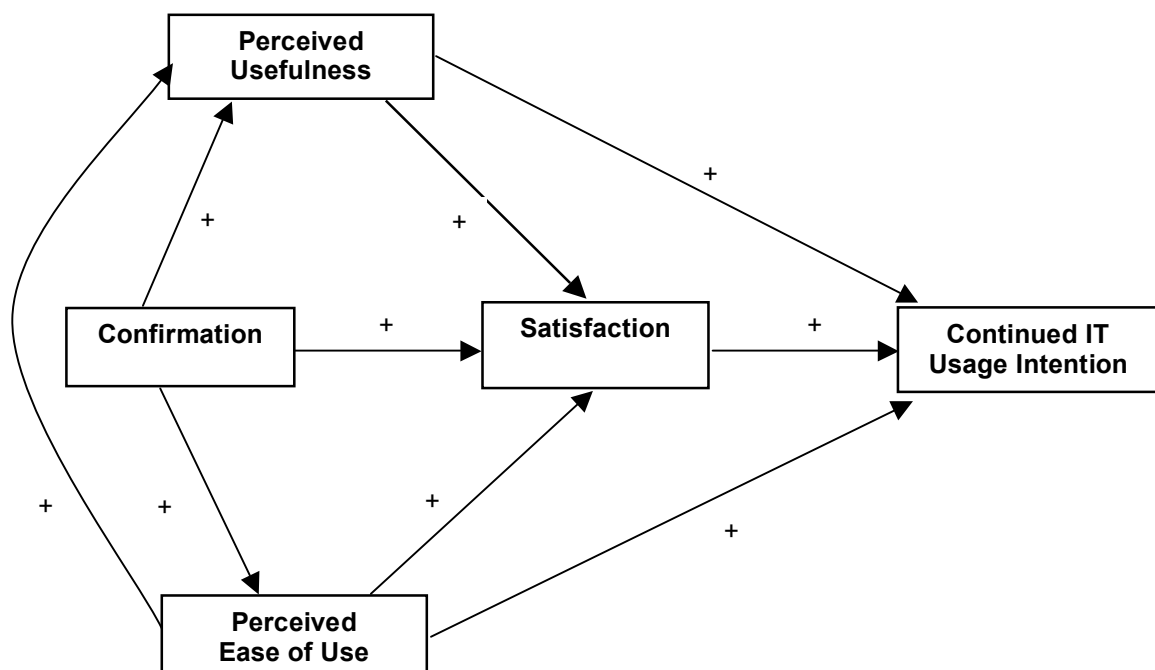


Figure 2. Extended ECM-IT (EECM-IT)

4. Research Methodology

4.1 The Context of the Study

Prior IT adoption studies have investigated innovations at two levels. The first level is at the application level, such as e-mails (Szajna, 1996), Windows operating system (Karahanna et al., 1999), and word processing system (Davis et al., 1989). The second level is at the general level of technological innovation, such as computing in general (Compeau et al., 1999); telemedicine (Chau and Hu, 2002); and personal computer (Igarria et al., 1996). This study focuses on mobile data services (MDS) provided by mobile phones, which is at the general level of innovation.

Data were collected from *current users* of MDS, i.e., users who had subscribed to MDS with a mobile phone and were using it at the time of the study. MDS refers to the convergence of mobile communication technologies with information and data communication services (ITU, 2002). It can be accessed using a hand-held mobile device, such as a mobile phone, over a wide geographic area on a subscription basis. It enables individuals to exchange multimedia messages (e.g., SMS, MMS), download digital information from the Internet, book theater tickets, enjoy online games, and many other services on the road. MDS has shown exponential growth in terms of subscribers and range of services over the last few years, especially in some Asian and European countries such as Hong Kong, Japan, Korea, and Finland. Since MDS can be regarded as a wireless version of subscription-based commercial online information services, subscribers' continued usage behavior is especially critical for its rapid growth in the market.

4.2 Questionnaire

The question items were taken from previous studies (Bhattacharjee, 2001b; Davis, 1989) and reworded to suit the context of the current study, which is the continued usage of MDS. The first question of the online survey was designed to divide the respondents into two groups: current users and potential users. It asked each respondent if one was using MDS at the time of the survey. Depending on the answer (i.e., yes or no), the respondent was presented with a corresponding questionnaire. As we are investigating continued IT usage behavior, only those who responded "yes" were included in the subsequent data analysis.

4.3 Data Collection Procedure

The questionnaire was administered on a non-profit public website run by the Hong Kong government. The website has been developed to provide residents with a wide array of e-government services, such as filing tax return, booking public facilities, checking traffic information, appointment booking for various government services, and renewal of driving licenses. It is run on a free-membership basis and is open to residents of Hong Kong.

A banner advertisement of the survey was put on the public website for a period of four weeks. To encourage participation, incentives of the latest models of mobile phones and MP3 players were offered as lucky draw prizes. A total of 1,826 valid responses were collected from the current user group³. 817 respondents were males (44.7%) and 1,009 were females (55.3%). The age of respondents ranged from 13 to 76 years, with a mean age of 25.4 years.

³ In total, there were 8,941 respondents who successfully completed the questionnaires; of which 7,045 were potential users and 1,826 were current users.

Most of the responses came from people in their 20s (53.1%), their 30s (18.0%), or teenagers (23.6%). The period of using MDS ranged from 1 to 44 months, with a median of 15 months, and a mean of 17.2 months.

Table 1. Summary of Fit Indices

Fit Indices	Recommended Value	Measurement Model	Structural Model
GFI	≥0.90	0.99	0.99
AGFI	≥0.80	0.99	0.99
NFI	≥0.90	0.97	0.97
NNFI	≥0.90	0.97	0.97
CFI	≥0.90	0.97	0.98
RMSR	≤0.10	0.08	0.06
RMSEA	≤0.08	0.05	0.05
χ^2 (df, p)	-	428.46 (80, p< .01)	428.49 (81, p< .01)

Table 2. Summary of Psychometric Properties of Constructs and Items

Construct Measurement	Mean	Standard Deviation	Factor Loadings	Squared Multiple Correlations	Composite Reliability	Average Variance Extracted
Continued IT Usage Intention					0.85	0.73
INT1	4.71	1.20	0.89	0.79		
INT2	4.94	1.13	0.82	0.68		
Perceived Usefulness					0.94	0.84
PU1	4.36	1.26	0.91	0.84		
PU2	4.52	1.21	0.94	0.89		
PU3	4.62	1.30	0.88	0.78		
Perceived Ease of Use					0.89	0.74
PEU1	4.54	1.12	0.90	0.82		
PEU2	4.11	1.17	0.87	0.76		
PEU3	4.42	1.16	0.80	0.64		
Confirmation					0.93	0.81
CON1	3.92	1.12	0.92	0.84		
CON2	3.86	1.12	0.92	0.85		
CON3	4.04	1.17	0.86	0.74		
Satisfaction					0.92	0.74
SAT1	4.15	1.05	0.85	0.72		
SAT2	4.23	1.02	0.86	0.75		
SAT3	4.00	1.09	0.90	0.80		
SAT4	4.15	1.10	0.82	0.67		

Table 3. AVEs and Shared Variances

	INT	SAT	PU	PEU	CON
INT	0.73				
SAT	0.18	0.74			
PU	0.52	0.07	0.84		
PEU	0.53	0.18	0.36	0.74	
CON	0.14	0.29	0.11	0.18	0.81

Note: INT—Continued IT Usage Intention, PEU—Perceived Ease of Use, PU—Perceived Usefulness, SAT—Satisfaction, and CON—Confirmation, AVEs are shown on the diagonal (shaded).

4.4 Instrument Validation

A confirmatory factor analyses using LISREL 8.50 was performed on the measurement model. The fit of the measurement model was estimated with various indices (see Table 1). However, the chi-square statistic and the normed chi-square were not used in this study because of their inherent sensitivity to large sample size (Hair et al., 1992, p. 492). The goodness-of-fit (GFI) and adjusted goodness-of-fit (AGFI) were both 0.99. The values of the normalized fit index (NFI), non-normalized fit index (NNFI), and comparative fit index (CFI) were 0.97 also indicating good model fit (Chau, 1997). The observed values for root mean square residual (RMSR) and root mean square error of approximation (RMSEA) were 0.08 and 0.05 respectively, which were within the recommended cutoff values of 0.10 for RMSR and 0.08 for RMSEA for goodness of fit.

The psychometric properties of the constructs and items are summarized in Tables 2 and 3. The composite reliability estimate for each construct ranged from 0.85 to 0.94, suggesting acceptable levels of reliability (Hair et al., 1992). The average variances extracted (AVEs), ranging from 0.73 to 0.84, were all above the recommended 0.50 level (Hair et al., 1992), which meant that more than 50% of the variances observed in the items were accounted for by their hypothesized constructs. According to Fornell (1982), factor loadings in excess of 0.70 could be considered excellent for convergent validity. All the factor loadings were greater than 0.70. Following Hair et al.'s (1992) guideline, all squared multiple correlations should be above the 0.40 threshold for convergent validity. Table 3 shows that the squared multiple correlations of the individual items were high, ranging from 0.64 to 0.89. To examine discriminant validity, we compared the shared variances between the constructs with the average variance extracted from the individual constructs (Fornell and Larcker, 1981). All the shared variances (i.e., squared correlations) were lower than the AVEs, indicating adequate discriminant validity (see Table 3).

5. Empirical Results

After validating the measurement model, a LISREL analysis was performed on the structural model. The weighted least squares (WLS) method was used to estimate the coefficients of the associations among the variables. When non-normality of the data exists, which was the case with our sample, employing an estimation method that allows for non-normality is more appropriate (Bollen, 1989, p. 425; Joreskog and Sorbom, 1993, p. 45). The advantages of using the WLS estimation method are that it does not assume the normal distribution of variables as a necessary condition for estimation and is asymptotically efficient.

From Table 1, the structural model also showed an adequate fit (GFI = 0.99, AGFI = 0.99, NFI = 0.97, NNFI = 0.97, CFI = 0.98, RMSR = 0.06, RMSEA = 0.05). All the hypothesized paths were significant, except for the path between perceived usefulness and satisfaction (see Figure 3). The effect of the newly added perceived ease of use was salient in the extended ECM-IT; it had direct positive impact on satisfaction, whereas perceived usefulness did not. Also, perceived ease of use had a strong direct influence on intentions. In summary, the extended ECM-IT accounted for 67% of the variance in users' intentions to continue usage, 34% of the variance in user satisfaction, 37% of the variance in perceived usefulness, and 35% of the variance in perceived ease of use.

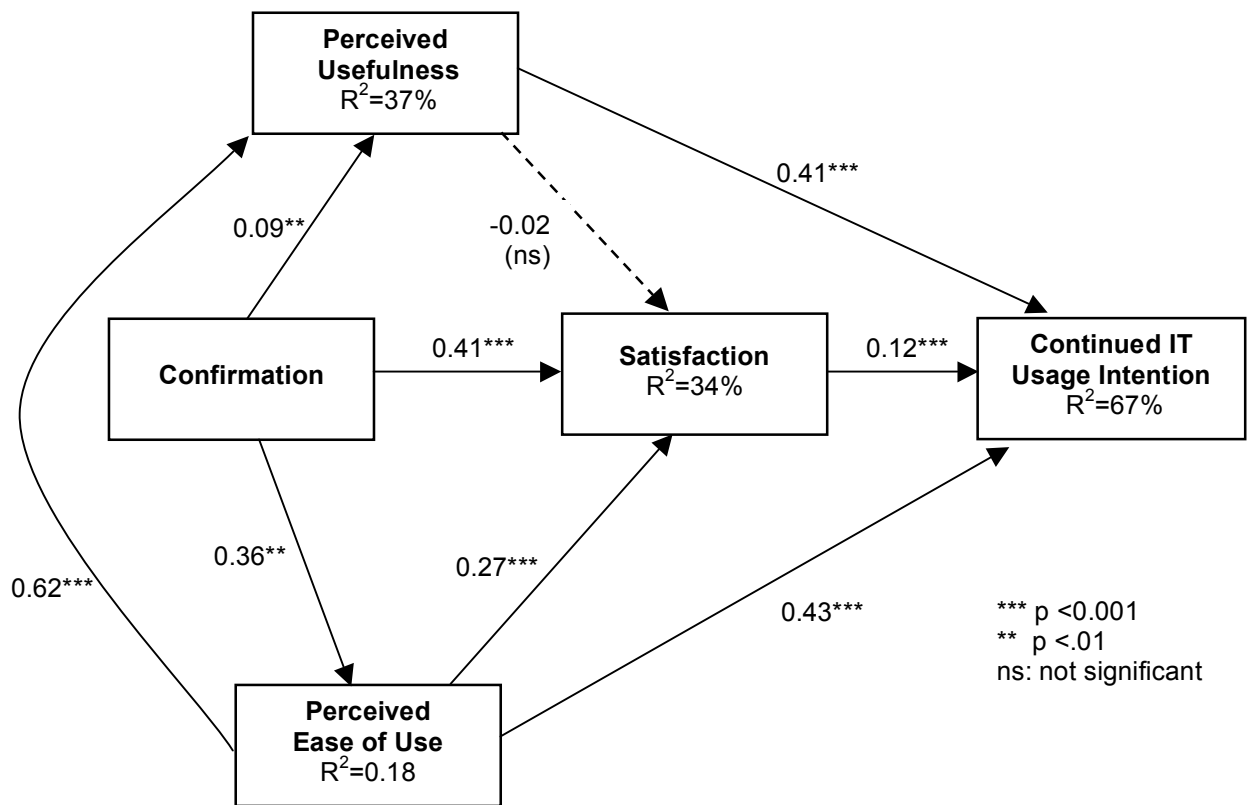


Figure 3. Summary of Extended ECM-IT (EECM-IT) Results

6. Discussion

6.1 Perceived Usefulness: A Major Driver of Continued IT Usage Intentions

A notable finding in this study was the strong influence of perceived usefulness on user intentions. Contrary to Bhattacharjee's (2001b) finding, perceived usefulness was the stronger predictor of user intention than satisfaction in our test. This pattern of association is similar to what researchers have found in the early adoption studies based on TAM. Some expectancy-confirmation paradigm researchers suggest that satisfaction is another type of affect (LaTour and Peat, 1979; Czepiel and Rosenberg, 1977). In the early version of TAM, perceived usefulness showed strong direct association to intention over and above user affect (e.g., Taylor and Todd, 1995; Mathieson, 1991; Davis et al., 1989). This is because people are believed to form intentions toward using an IT based on a cognitive appraisal of how it will help them achieve a valued goal, not just on their affective feelings toward using the IT (Davis et al., 1989). From this perspective, the objective-contingent cognition seemed to hold stronger than satisfaction (affect) in the current post-adoption context. Further empirical validations on the relative size of impact between these two variables will be useful in future research.

6.2 Strong and Sustained Impact of Perceived Ease of Use in Post Adoption Context

Another surprising finding was that the impact of perceived ease of use on continuance intention was just as strong (and even slightly higher) as that of perceived usefulness. This is a departure from the findings in the prior adoption studies suggesting that the impact of

perceived ease of use is diminished over time as users get used to an IT (Davis et al., 1989). This strong direct impact of perceived ease of use on continuance intention is believed to be due to the nature of the technology studied in this paper (i.e., MDS). The rapid growth of the MDS market is accompanied by the introduction of numerous new features and content. Therefore, while MDS rapidly evolves, MDS users have to continue to put effort into keeping abreast of the changing technology. Further, due to the limited system resources to deliver the contents of MDS (e.g., small screen, small and inconvenient input method, limited memory), users often need to make extra effort to access or update the contents (e.g., more navigations, extra steps with service menu). Given that these usability issues are closely related to perceptions of ease of using or learning a system (Nielsen, 1993), it is likely that perceived ease of use could have a larger influence on MDS users' post-adoption behavior.

6.3 Weak Association between Perceived Usefulness and Satisfaction

The impact of perceived usefulness on satisfaction turned out to be non-significant. This may stem from the characteristics of the technology used in this study, which is MDS. As Kwon and Zmud (1987) noted, IT adoption and usage research should take into consideration the influence of contextual aspects, such as the characteristics of the technology under investigation and their interaction with various external factors. In ECM-IT, perceived usefulness is supposed to represent post-adoption expectation, because perceived usefulness has been the most salient cognitive belief that forms expectation (Bhattacharjee, 2001b). However, the scope of expectation can be much broader encompassing many different cognitive beliefs, such as perceived ease of use that was observed in other adoption studies. In the case of MDS, the scope of cognitive beliefs may be especially broad, given the wide range of users and usage contexts (Economist, 2001). Given that, post-adoption expectations about using MDS should capture many different desires and beliefs of a user.

Similarly, the Theory of Reasoned Action (TRA) supports our perspective in that users' attitude towards a target behavior consists of various beliefs (Ajzen and Fishbein, 1980). Perhaps, for a technology like MDS, representing expectation with only one belief (perceived usefulness) is inadequate. The current results imply that users' goal-driven aspect of perception, which is instrumental to achieve a certain goal such as gaining productivity or recognition (i.e., perceived usefulness), provide only partial contribution to developing their satisfaction towards using MDS. Given the wide range of user base and the usage context of MDS, this result enables us to conjecture that many users may seek satisfaction from various usage contexts rather than from a performance-oriented context, which has been the main focus of previous IS research. According to an ITU report (ITU, 2002), MDS will make new demands on our lifestyle. In its vision for the future of the wireless society, the Wireless World Research Forum (2000) suggests that it will become more and more important how users perceive the emotional impact and pleasure that the service creates and maintains. One possible future research is to include various beliefs that are thought to be relevant to the IT in the model and observe their impact on satisfaction, which may help better understand the structure of user satisfaction.

6.4 Association between Confirmation and Post-Adoption Expectation Beliefs

As theorized in Bhattacharjee's study (2001b), users' confirmation level through the post-adoption usage experience had positive impact on users' post-adoption expectations (perceived usefulness and perceived ease of use). The result supports that initial expectation changes following users' usage experience, and this revised expectation in turn has significant impact on subsequent cognitive processes, such as satisfaction and intention

(Bhattacharjee, 2001b). Further empirical studies with different technologies at different development stages will help better understand this association.

6.5 Implications

From the practical point of view, the utility of the extended ECM-IT, as evidenced by the empirical results, can provide IT practitioners, such as online service providers, with deeper insights into how to address customer retention and continued usage of their products and services⁴. Customer retention is crucial to the successful adoption of an IT innovation and may even determine the survival of the company promoting the IT innovation in the marketplace (Anderson and Sullivan, 1993). The results suggest that in order to encourage continued IT usage, managing users' satisfaction levels as well as certain post-adoption beliefs will be critical. User satisfaction is very important for service providers to retain customers and generate profits (Bhattacharjee, 2001a): satisfied customers are an effective advertising channel via word-of-mouth as well as a stable revenue source via repeat business. In the past, however, user satisfaction with IT products or services did not receive much attention by IT product/service practitioners or IT adoption researchers, because most IT innovations were considered a tool for users to achieve a certain goal within organizations where performance-oriented aspects of IT innovations are more valued than users' affection towards them (e.g., Davis et al., 1989). As more and more IT innovations become commercially available to individual users like consumer products, it is very likely that user satisfaction with an IT plays a crucial role in determining its success in the market.

The extended ECM-IT sheds light on the development of user satisfaction and usage intention through their associations with two widely employed beliefs. The strong impact of perceived ease of use on user intentions and satisfaction particularly deserves attention from practitioners as well as the research community. Compared to the effect of the functional usefulness of a system, that of ease of use has been underestimated by IT adoption researchers. Perception of ease of use is closely related to usability design in that both are concerned with enhancing the way people interact with a system (Nielsen, 1993). A recent view of the usability design research community is that well-designed IT products and services can support people in their everyday life, because IT is no longer just for work (Preece et al., 2002). It is widely accepted that good user experience through better usability design can increase the value of IT products in the commercial market (Carroll, 1997). From this perspective, our results suggest that MDS providers should put more efforts to making their services easier to use, which can lead to better user satisfaction, and eventually a great market success. At a higher level, the strong effect of perceived ease of use implies that the nature of an IT of interest can be an important boundary condition to understand the users' decision-making processes in the context of continued IT usage. Many prior IT adoption studies did not incorporate the nature or unique characteristics of IT into the analyses (Benbasat and Zmud, 2003). The current study provides an insight into future research on the continued usage of IT, especially those with a complex nature.

7. Conclusions

This study has proposed an extension to the ECM-IT model and provided further evidence of its utility in considering post-adoption variables, such as perceived usefulness, perceived ease of use, satisfaction, and confirmation. One important criterion in considering the utility

⁴ We also tested the data on the original ECM-IT (Bhattacharjee, 2001b), which explains only 50% of the variance in continued usage intention. This comparison not only shows the utility of the extended ECM-IT, but also provides further support for the importance of perceived ease of use in the continued usage of complex technology like MDS.

of a model is the value of the information that the model can deliver (Mathieson, 1991). From this perspective, the extended ECM-IT can provide abundant information to allow a more complete explanation of users' post-adoption behavior. On the other hand, further development and test of the extended ECM-IT could advance research into the continued IT usage behavior. Potentially, the constructs of the extended ECM-IT could be combined with other synergistic variables in predicting continued IT usage. Further, the implication that our model has to technologies of a complex nature demands that the IT adoption research community give careful consideration to different nature of technologies to improve the understanding of user decision-making processes. The current study has shed light on the possible formulation of a richer post-adoption model. Indeed, more empirical tests of the extended ECM-IT in different IT contexts with additional relevant variables will be valuable.

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